CHAPTER 2.2.1.13: VIOLET STINGRAY	**AUTHORS: A. DOMINGO, R. FORSELLEDO, F. MAS, P. MILLER**	**LAST UPDATE: August 2022 Original: Spanish**

2.2.1.13 Description of Violet Stingray (PLS)

1. Names

1.a. Taxonomy and classification

Name of species: *Pteroplatytrygon violacea* (Bonaparte, 1832)

Etymology: Pteroplatytrygon: Composed of three words from the Greek language, *pteron* = πτερόν meaning "wing"; *platys* = πλάκες meaning "flat", "wide"; and *trygon* = which derives from τρίγωνος (*trigōnos*) meaning "three corners", "triangular". *Violacea* comes from Latin *violaceus* and means "with violet colour".

ICCAT species code: PLS

Synonyms: *Dasyatis violacea* (Bonaparte, 1832); *Trygon violacea* (Bonaparte, 1832); *Trygon purpurea (*Müller and Henle, 1841) *Dasyatis purpurea* (Müller and Henle, 1841); *Dasyatis purpurea* (Müller and Henle, 1841); *Dasyatis atratus* (Ishiyama and Okada, 1955); *Dasyatis guileri* (Last, 1979)

ICCAT names: Pelagic stingray (English), Pastenague violette (French), Raya látigo violeta (Spanish)

According to ITIS (Integrated Taxonomy Information System), classification is carried out as follows:

- Phylum: Chordata
- Subphylum: Vertebrata
- Superclass: Chondrichthyes
- Class: Chondrichthyes
- Sub-class: Elasmobranchii
- Superorder: Euselachii
- Order: Myliobatiformes
- Family: Dasyatidae

1.b. Common names

List of vernacular names in use according to ICCAT, FAO and Fishbase (www.fishbase.org). List is not exhaustive, and may exclude some local names.

Australia: Guilers stingray, Pelagic stingray, Violet stingray
Brazil: Raia Roxa
Canada: Pelagic stingray, Pastenague, K'ak'ew', Black skate
China: 吉勒氏魟, 紫魟, 黑魟
Croatia: Žutuga ljubičasta
Czech Republic: Trnucha pelagická
Denmark: Pelagisk pigrokke, Pigrokke, Pilrokke
Ecuador: Violet stingray
Estonia: Ulgurai
Finland: Sinikeihäsrausku
France: Pastenague violette

French Polynesia: Pelagic sting-ray
Germany: Peitschenrochen, Pelagischer Stechrochen, Stechrochen, Violetter Stechrochen
Greece: Glafkotrygona, Sálahi trygéna, Trigóna, Γλαυκοτρυγόνα, Μούντριζα, Μούτρουβα, Σαλάχι, Τρυγόνα
Indonesia: Pari lemer, Payubek, Pari lampin
Italy: Brucco, Bugghiu niru, Dragone, Ferraccia, Ferrassa neigra, Ferrazza, Matana, Muchio spinoso, Pastinaca, Hurchje, Pastinaca violacea, Prelato, Protene, Tomazzo, Trigone viola, Trigóna, Vastunaca, Vastunaca spinosa, Vurchie
Japan: Karasu-ei
Malaysia: Guilers stingray, Pelagic stingray, Violet stingray, Pari, Pari hitam
Malta: Violet stingray, Trigone violetto, Boll, Boll tork, Boll vjola
Mexico: Stingring, Raya látigo obispo, Raya látigo pelágica
Namibia: Pelagiese pylstert, Pylstert, Pelagic stingray, Stingray
Netherlands: Violette pijlstaartrog
New Zealand: Pelagic stingray
Norway: Pilrokke, Pilskate
Panama: Raya látigo
Poland: Ogoncza pelagicza, Ogoncza pelagicza
Portugal: Blue stingray, Pelagic stingray, Violet stingray, Ratão, Uge-violeta
Serbia: Siba zutulja, Volina
South Africa: Pelagiese pylstert, Pelagic stingray
Spain: Escunçana violeta, Escunçana violeta, Pastinaca, Raya látigo violeta
Sweden: Stingrocka, Violett spjutrocha, Violett spjutrocha
Türkiye: İğneli vatoz, Ignelivatoz
United Kingdom: Blue stingray, Pelagic stingray, Violet stingray
United States: Pelagic stingray
Uruguay: Raya negra

2. Identification

It was originally described in the Mediterranean Sea and Atlantic Ocean by Bigelow and Schroeder (1962). It is medium size, around 60 cm and reaches a maximum of 90 cm disc width (DW) (Vaske Júnior and Rotundo, 2012). It is the only pelagic ray species (Mollet, 2002).

Figure 1. Image of a violet stingray *Pteroplatytrygon violacea*. Photograph: National Observer Programme onboard the Uruguayan tuna fleet (PNOFA-DINARA-Uruguay).

Characteristics of *Pteroplatytrygon violacea*

It is an easily recognised species. It is medium sized, with a flat cone-like disc. It has a wide head and a very short snout that protrudes slightly from the anterior disc margins, very small eyes, and very wide inter-orbital space. The tail has a broad base, and is whip-like beyond the caudal stinger, with a well-developed membranous fold on the ventral surface underneath the spine. It has a continuous row of small thorns along the midline. The mouth is small with numerous short and bifurcated oral papillae; prominent lip furrows and folds; slightly convex lower jaw (McEachran and Capapé, 1984; Last *et al*., 2016).

Sizes

While the maximum recorded size is 90 cm disc width (DW), it is generally shorter than 60 cm (DW) (Vaske Júnior and Rotundo, 2012).

Colouring

Ventral surface of disc and tail dark brown or black in colour. Upperside, tail folds and whip-like section of the tail are uniformly black. Mostly pale cloaca, thorns and stinger. No other ray has a uniformly dark disc on the dorsal and ventral surfaces (Last *et al*., 2016).

External characteristics

It has a continuous line of small thorns along the back, a single row from the nape to caudal spine. The caudal spine is characteristic of the species (Schwartz, 2005).

Internal characteristics

Sexual dimorphism between teeth in males and females is observed. While in the upper jaw in both sexes, the number of rows of teeth increases with disc width, in the lower jaw, the number of rows of teeth increases in males but not in females. The amount of teeth in the upper and lower jaws varies between the sexes, and the amount of serrations on the lateral edges differs significantly between males and females (Cave *et al.,* 2013).

3. Population distribution and ecology

3.a. Geographic distribution

Circumglobal distribution, in temperate, subtropical and tropical areas (Mollet, 2002; Neer, 2008). Distributed in the Atlantic from at least 55ºN to 42ºS (Forselledo *et al*., 2008; unpublished DINARA data). In the Mediterranean, McEachran and Capapé (1984) observed that it was found off the North African coast and in the Tyrrhenian Sea. Other records locate it in the Ligurian, Ionian and Adriatic Seas and eastwards, including in the eastern basin, off the coasts of Türkiye (Orsi Relini *et al*., 1999; Jukic-Peladic *et al*., 2001; Mavric *et al*., 2004; Erguden *et al.,* 2018).

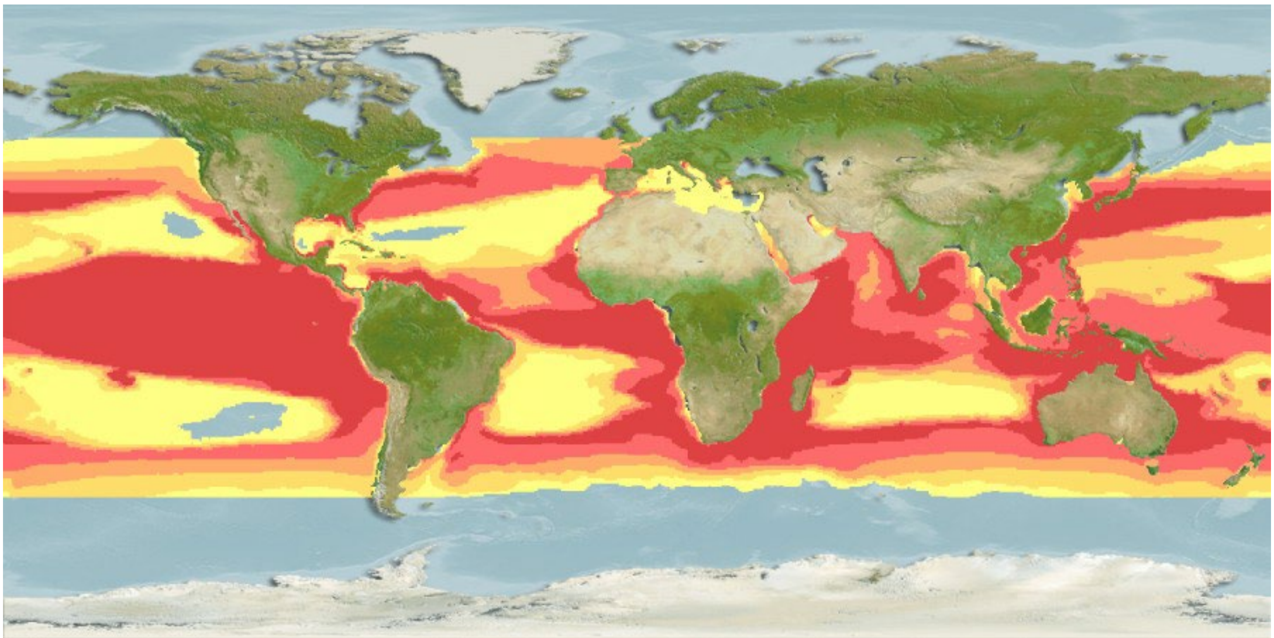

Figure 2. Geographic distribution of *Pteroplatytrygon violacea.* Taken from FishBase (https://www.fishbase.de/summary/Pteroplatytrygon-violacea.html)

3.b. Habitat preferences

Over its distribution area both in the Atlantic Ocean and the Mediterranean Sea, it is most abundant in areas outside of the shelf than in the neritic zones (Báez *et al*., 2016; Domingo *et al.,* 2005). It has been caught in shallow areas, one metre deep, in warm regions (Marion *et al*., 2014).

Its distribution in the water column is probably related to the geographic location and environmental parameters of the region, being found from the surface to at least 428 m (Verás *et al*., 2009).

This species has shown a preference for waters with surface temperatures above 20ºC or, in summer, waters with the highest temperatures (Domingo *et al*., 2005; Báez *et al*., 2016). Even so, there are records from bottom trawl fisheries in the North Sea between 50 and 70 meters and with temperatures between 9 and 10.2ºC (Ellis *et al.*, 2007).

Females are more frequently caught near the surface and males in deeper waters. Ribero-Prado and Amorim (2008) obtained a higher proportion of males in sets where the fishing gear was placed deeper (up to 800 meters) while females were more frequent in shallow sets (from 60 m). Several findings in shallower waters and bottom trawl fisheries relate this species with the seabed and suggest that it is more correct to define violet stingray as a benthopelagic species. It was observed that a female measuring 56.5 cm (DW), tagged with a satellite transmitter (miniPAT), was found for part of the time (around 10%) in shallow waters (0-50 m) of the South West Atlantic. For the rest of the time (90%), it was observed in waters below 50 m, and around 50% of the time in waters between 100 and 150 m. The data obtained indicates that violet stingray prefers waters below the thermocline (100-150 m), spending less time in the mixed layer (Véras, 2012). Other studies with satellite transmitters showed that four individuals frequented deeper waters in the daytime with frequent movements of short duration (around 5 minutes) and immersions of some 50 m (Weidner *et al.,* 2012).

3.c. Migration:

There is no information on possible migrations of this species.

4. Biology

4.a. Growth

Validated growth parameters have not been obtained. The data obtained by Neer (2008) from vertebrae readings of a few specimens of *P. violacea* have not yielded results on the L_∞, k and t_0 parameters. In these studies, the maximum age observed was 10 years. The only known available data were estimated within the framework of a post-graduate thesis based on 348 specimens obtained in the South Equatorial Atlantic (Passo, 2009). The values obtained are low and indicate slow growth rates in comparison with elasmobranchs in general. Other researchers have observed that *P. violacea* females are larger and weigh more than males (Véras *et al.,* 2014).

Table 1. Growth parameters for *Pteroplatytrygon violacea* according to the Von-Bertalanffy growth model. L_∞: Maximum asymptotic length (cm), k: growth coefficient (years^{-1}), t_0: theoretical age at size 0 (years).

Growth Parameters			Area	Reference	Sex	Method
L_∞	k	t_0				
91.53	0.073	-5.26	South Equatorial Atlantic	Passo (2009)	Females	Vertebrae
78.53	0.10	-4.16	South Equatorial Atlantic	Passo (2009)	Males	Vertebrae

4.b. Length-weight and length-length relationship

Table 2 shows the length-weight relationships published in various geographical areas in the Atlantic.

Table 2. Length-weight relations published for *Pteroplatytrygon violacea*. DW: disc width (cm); DL: disc length (cm); TW: total weight (kg); GW: gutted weight (kg).

Equation	N	Size range	Sex	Area	Reference
ln(DL) = 1.1126 x ln(DW) - 0.7227	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 0.941 x ln(GW) + 0.2627	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 3.1294 x ln(DW) - 4.3482	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(GW) = 2.9591 x ln(DW) - 3.8851	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 2.6354 x ln(DL) - 1.6755	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(GW) = 2.4882 x ln(DL) - 1.3443	184	28-66	Females	Southwest Atlantic	Véras *et al.* (2014)
ln(DL) = 1.0659 x ln(DW) - 0.5429	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(GW) = 0.9987 x ln(TW) - 0.1414	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 2.599 x ln(DW) - 2.377	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(GW) = 2.6446 x ln(DW) - 2.7026	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 2.1401 x ln(DL) - 0.0032	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(GW) = 2.1408 x ln(DL) - 0.157	290	34-59.6	Males	Southwest Atlantic	Véras *et al.* (2014)
ln(TW) = 2.552 x ln(DW) – 3.386	17		Males	Mediterranean Sea	Hemida *et al.* (2003)
ln(TW) = 2.828 x ln(DW) – 4.082	27		Females	Mediterranean Sea	Hemida *et al.* (2003)

4.c. Reproduction

The species is characterised by aplacental viviparous reproduction and nutritive trophonemata, long thread-like extensions from the uterine epithelium that secrete "uterine milk" which is absorbed by the embryos (Véras *et al.,* 2014). Single functional uterus in adults (Hemida *et al.,* 2003).

Ovarian vitellogenesis appears to occur simultaneously with gestation, which would indicate that females are ready to ovulate shortly after birth (Véras *et al.,* 2009).

Data obtained in captivity indicate that gestation can occur over a period of two months, twice a year (Mollet *et al.,* 2002). In the case of specimens in their natural environment, it was estimated that the gestation period could occur over a period of 4 to 5 months (Forselledo *et al*., 2008), while some studies in the Mediterranean Sea indicated that this period lasted two months (Hemida *et al.,* 2003).

The reproductive process (fertilization, embryonic development and parturition) was observed to take place between spring and early autumn in both the Mediterranean Sea and the southwest Atlantic. Hemida *et al.* (2003) observed a possible diapause in violet stingray from the Mediterranean Sea during winter, possibly due to lower water temperatures or even sperm storage during this period. This may also occur in the southwest Atlantic between May and October (autumn and winter) (Forselledo *et al*., 2008).

Parturition and pupping

Studies in captivity have observed that newly born pups have a disc width of between 14 and 24 cm (Mollet *et al.,* 2002), while various researchers have found females in the last stages of pregnancy in their natural habitat in the South Atlantic, with embryos of between 14.2 and 18.8 cm DW (Forselledo *et al*., 2008; Ribeiro-Prado and Amorim, 2008; Véras *et al*., 2009).

Studies carried out with data obtained in the southwest Atlantic from 24 to 39ºS found higher gonadosomatic indices in females in the summer (January), which could indicate that they were closer to the parturition period. Females with embryos in distinct stages of development were caught in the summer and early autumn (January-April), one of which had dark-coloured embryos of up to 15 cm, similar to neonates (Forselledo *et al.* 2008). Fifty percent of the females examined by Forselledo *et al*. (2008) in summer (n = 44) contained embryos, compared to 7% of those analyzed in autumn (n = 15), which were found in early autumn. No embryos were found (n = 41) in other seasons (winter and spring). The average number of embryos per female was 4 (range: 1-7; n = 23) and the smallest embryos measured 4 cm, while the largest reached 15 cm (DW) and were already pigmented. Parturition probably occurs in early autumn (April) in this region of the Atlantic (Forselledo *et al.,* 2008; Ribeiro-Prado and Amorim, 2008).

Hemida *et al.* (2003) estimated a size at birth of between 16 and 19 cm (DW) in the Mediterranean Sea.

Maturity

Some studies in the southwest Atlantic indicate sizes at first maturity of 34 to 43.5 cm disk width for males. Sizes at first maturity for females ranged from 45 to 46 cm DW (Ribeiro-Prado and Amorim, 2009; Véras *et al*., 2009). These values are similar to those suggested by Last *et al.* (2016) for the species at the global level of 35-38 cm DW for males and 39-50 cm for females. Neer (2008) found much higher ranges of size at maturity (DW) for males than those presented by Last *et al.* (2016) and those found in the southwest Atlantic (37.5-47.8 cm).

For the Mediterranean Sea, sizes of between 42 and 52 cm DW were found for male adults and between 45 and 61 cm for female adults (Hemida *et al*., 2003).

Fecundity

Data obtained in captivity suggest that females have between 4 and 13 embryos per gestation (Mollet *et al.,* 2002). These values are higher than those obtained for individuals observed in their natural habitat.

In the southwest Atlantic, Véras *et al.* (2009, 2014) found an average fecundity of between 3.5 and 3.7 embryos per female in different periods, which is consistent with the observations of Mazzoleni and Schwingel (2002), and an average ovarian fecundity of between 5.4 and 8.3 oocytes (n = 64). These averages are very similar to those observed in a more southern area of the same region (4 embryos) (Forselledo *et al*., 2008).

Hemida *et al.* (2003) found an ovarian fecundity of 5 to 10 oocytes and the number of fertilised eggs and embryos varied between 2 and 7 in the Mediterranean Sea.

4.d. Diet

The diet of the violet stingray is very varied and adapts to the environment where it is found. Although representatives of the pelagic environment are the main part of its diet, organisms associated with the ocean floor are also found.

In the North Atlantic, in the southern part of the United States and the Gulf of Mexico, an analysis of stomach content showed that the main prey were cephalopod molluscs (59.18%), followed by actinopterygian fish (37.75%) and decapod crustaceans (35.71%) (Weidner *et al*., 2017). Previous studies found seahorses (*Hippocampus* sp.), small shrimps, fragments of squid, parts of a thalassic decapod, sargassum seaweed and squid beaks, among others (Bigelow and Schroeder, 1962; Scott and Tibbo, 1968; Wilson and Beckett, 1970).

Studies carried out in the South Atlantic analysing the diet of the violet stingray show distinct results as regards the main or most frequent component. In a study of individuals caught in very deep trawl fisheries (15 to 50 metres), Vaske Júnior and Rotundo (2012) found that all the prey were pelagic or medium-sized organisms of coastal waters, indicating a clear preference for active medium-sized fish. Contrary to these findings, in a very close region, other researchers found that small crustaceans were a major part of the diet and that they also fed on fish and cephalopods (Véras *et al.,* 2009a). On the other hand, slightly further south than Véras *et al.* (2009a), Ribeiro-Prado and Amorim (2008) found that molluscs were the most common group, with a predominance of *Loligo* sp.

In the Mediterranean, the diet consisted of two major taxonomic groups, teleost fish and cephalopods, but few crustaceans. The size of the prey was positively correlated to the size of the predator. It was confirmed that violet stingray is one of the major predators of pelagic fish species, although the presence of benthic prey shows that it also feeds on the ocean floor. The pelagic stingray, an active and voracious predator, mainly feeds on anchovies, which make up an important part of the diet of juveniles and adults of both sexes. (Lipej *et al*., 2013).

4.e. Physiology

The relationship between the number and density of electrosensorial and electrosensitive pores in chondrichthyans has been partly determined as a strategy to reference prey in organisms with a benthic diet. In this regard, the violet stingray has a considerably lower number of ventral electrosensorial pores than benthic ray species, suggesting that the violet stingray has mostly pelagic behaviour (Jordan *et al.,* 2009).

Another aspect to point out regarding this species is the existence of abnormal hermaphroditism, a condition that has been documented for very few batoid species (Ribeiro Prado *et al*., 2009).

The differences found in the teething and locomotor behaviour of this species compared to other rays of the genus Dasyatis appear to be functional adaptations to a pelagic lifestyle and a diet of fish and squid (Rosenberger, 2001).

4.f. Natural mortality

There are no estimated data on natural mortality for this species.

5. Fisheries biology

5.a. Populations/Stock structure

There are no studies showing population structures of this species.

5.b. Fisheries description: catch and effort

The majority of violet stingray catches are taken as bycatch in longline fisheries targeting tuna and swordfish (Mollet, 2002; Domingo *et al*., 2005). Smaller catches are taken by a variety of fishing geasr in different regions: purse seine (Arrizabalaga *et al*., 2011), tuna gillnet on the southeast coast of India (Akhilesh *et al.,* 2008), tuna pole and line in the North Atlantic (Iribar and Ibañez, 1978), pelagic trawl (Lipez *et al*., 2013; Antonenko *et al*., 2015; Bonanomi *et al*., 2018), pair trawl fishing on the Brazilian coast (Vaske Júnior and Rotundo, 2012); coastal artisanal fisheries in the southwest Atlantic (Espinola and Bernardo, 2007); lobster trawl in the North Sea (Ellis, 2007), bottom trawl (Mollet, 2002; Erguden *et al.,* 2018), squid jigging in Russian waters (Antonenko *et al*., 2015), gillnet in the Gulf of California, Mexico (Dávalos-Dehullu and González-Navarro, 2003), driftnet in Russia (Antonenko *et al*., 2015) and bait and line (Espinola and Bernardo, 2007).

Currently, the violet stingray has no commercial value and is the main species of chondrichthyans taken as bycatch by longline tuna fleets in the Atlantic Ocean and Mediterranean Sea, together with blue shark (Domingo *et al.,* 2005; Báez *et al*., 2016). This species is discarded whole in a rather peculiar way, as it has a saw-like spine in its tail that contains venom and is extremely poisonous. Contact with individuals is kept to a minimum during discards, and the specimens are often hit against the deck to loosen the hook (Domingo *et al.,* 2005). On the one hand, this discard method favours the rapid return of samples back into the water but, on the other hand, this often causes the jaw to break or be lost and leads to long- or medium-term effects resulting from a poor diet. Vaske Júnior and Rotundo (2012) noted that several rays studied had scars on their jaws and that they were feeding. Therefore it is likely that many rays that have been discarded with injuries survive and recover. They also found that one of the rays analyzed had scars on its tail, which were probably the result of an amputation carried out by fishers to avoid being injured by the tail bone. Poisson *et al.* (2019) estimated that mortality in pelagic longline is very low, from around 1 to 18%, mainly due to the resistance of this species when they are attached to the hook.

Catches of pregnant females in longline fisheries apparently induce parturition in around 85% of cases. This rate is considerably lower in the case of other gears, and more studies are required to better understand the rate of capture-induced parturition (Adams *et al.,* 2018).

In Canadian longline fisheries, more than 90% of pelagic ray bycatch was released alive from gears (Carruthers *et al.,* 2009). Bonanomi *et al.* (2018) found the same percentage (90%) for live discards in pelagic trawl fisheries in the central North Adriatic Sea.

Although no assessment has been carried out for the pelagic ray population, it has been included in some Ecological Risk Assessments (ERA) conducted in the Atlantic, Indian and Pacific Oceans (Cortes *et al*., 2010; Murua *et al.,* 2009; Arrizabalaga *et al.*, 2011; Cortes *et al.,* 2015; Griffiths *et al*., 2017; Murua *et al*., 2018). *Pteroplatytrygon violacea* was considered a low- or medium-risk species in all of these Ecological Risk Assessments. Furthermore, IUCN included it in the category of Least Concern in both the 2009 Red List assessment (Baum *et al.,* 2009) and 2019 Red List assessment (Kyne *et al.*, 2019), which was conducted using another methodology (*Just Another Red List Assessment*, JARA) developed by Winker *et al*. (2018).

In some cases, this has been attributed to the fact that other small species and previously rare species, e.g., the violet stingray, increased in abundance due to increased fishing pressure on commercially important species. However, the increase of smaller species did not balance the reductions of the biomass of large predators (Ward and Myers, 2005).

6. Others

Mankind has been aware of rays and their poisonous spines for many centuries and records and descriptions have been found as far back as the History of Animals by Aristotle (324-322 BCE). In addition, the American people (Mayas, Incas, etc.) have been aware of ray spines since 200-900 CE, as they were used in genital and body mutilation rituals (Schwartz, 2005).

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